SEPARATION OF DOLOMITE FROM PHOSPHATE AT LOW COST AND REDUCED ENVIRONMENTAL IMPACT

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Magnesium (MgO) in phosphate rock causes numerous problems in the phosphoric acid manufacturing process, including reducing filtration capacity, increasing sulfuric acid consumption, and making it difficult to meet product grade. MgO-containing minerals are fully dissolved and usually coexist in phosphoric acid by acid hydrolysis reaction to form $Mg(H_2PO_4)_2$. This makes it extremely difficult to separate the dissolved Mg from phosphoric acid. Therefore, it makes both economic and technological sense to remove dolomite from phosphate prior to acidulation. Except for limited use of heavy media gravity separation, flotation is the main technology currently practiced for separation of dolomite from phosphate. Because fine grinding is required to liberate dolomite for flotation separation, use of mechanical flotation cells is very expensive due to energy cost, long flotation time and high reagent use.

Recent development efforts have resulted in industry acceptance of an innovative flotation device, the packed flotation column (PFC), thus realizing its six (6) main advantages:

1. low energy use
2. long separation zone
3. small footprint
4. reduced water use
5. high throughput
6. effective for very fine particles

An industrial PFC, 12 meters tall and 3 meters in diameter, was installed at a phosphate mine in Hubei, China in early 2017 for separating dolomite from phosphate by flotation. Prior to switching the plant from mechanical flotation machines to PFC, long-term parallel testing was conducted, and the average results are shown in Table 1 for comparison.

Table 1. Parallel Plant Testing Comparison of PFC with Mechanical Cells.

Item	**Mechanical machine**	**PFC**
Capacity, dry tons/day	2000	2000
Machine volume, cubic meters	264	51
Power consumption, kilowatts	650	88
Fresh water use, cubic meter/hour	20-30	1-2
Flotation time, minutes	58	15
Operation mode	Manual	Computer control
Product grade, $\%P_2O_5$	30-31	30.7
Product grade, %MgO	0.60	0.50
$\%P_2O_5$ Recovery	~80	~80